F/A-18 & EA-18G NETWORKING

Christina Crowley
PMA-265 Advanced Development
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christina.crowley@navy.mil
phone- 301-757-6171
fax- 301-757-7665

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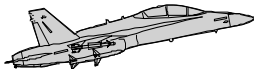
Key Messages

- **The F/A-18E/F and EA-18G aircraft physical architecture, with AESA, ATFLIR, MIDS/JTRS, DCS, ALR-67(V)3, JHMCS, SHARP, GPS-weapons, ANAV and the AEA sub-system will transform the way Navy fights.**

- **These aircraft possess the necessary building blocks that will allow Navy to operate, fight, and win on a joint, networked battlefield.**

- **The future of warfare – information superiority, increased speed, precision and accuracy – is here now.**
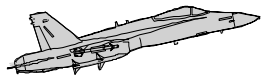
Spiral Development

- **Consistently fielded capability faster with less risk**
- **Proven C/P/S track record over the last 25 years**
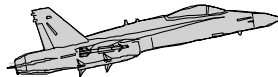- **Strong partner relationships exist with Hornet industry team**

F/A-18A/B
- Multi-mission strike fighter
- Glass displays
- AIM-7

F/A-18C/D
- Increased lethality
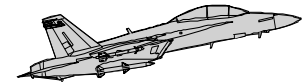- Avionics upgrade

F/A-18C/D Night Strike
- Night/adverse weather capability
- Enhanced performance engines
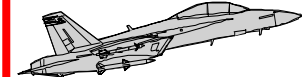- Increased survivability/lethality

F/A-18E/F Super Hornet
- Longer range
- Increased survivability/lethality
- Improved carrier suitability
- Tanker
- Room for growth
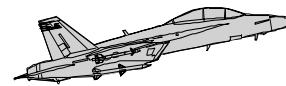
F/A-18E/F Block 2
- AESA
- Advanced Crew Station (ACS)
- Network Centric
- FORCEnet

EA-18G
- Airborne Electronic Attack (AEA)

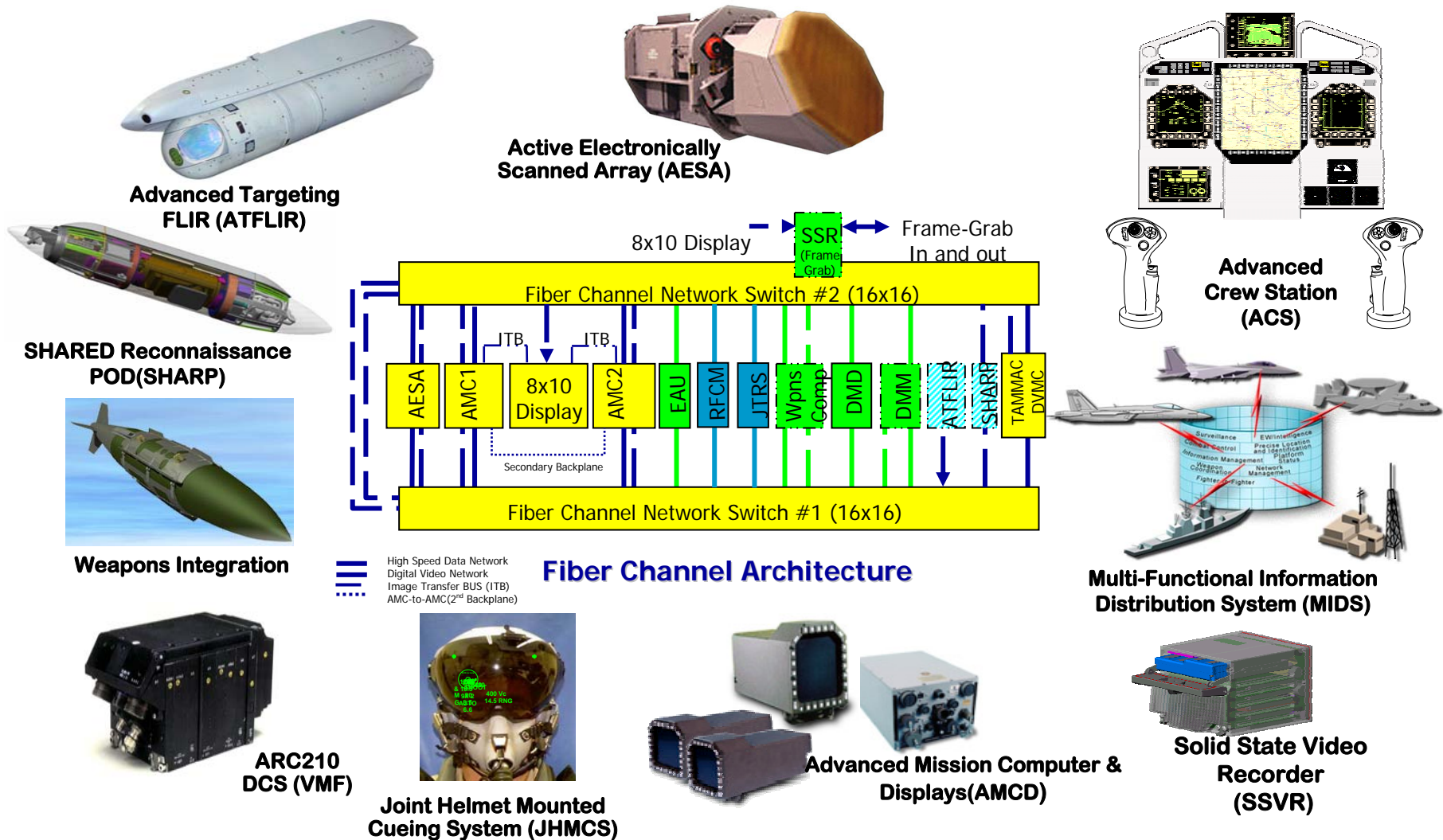Legacy SW/HW

1996

Block 2
High Order Language (HOL)

| 1980 | 1987 | 1990 | 2000 | 2008 |

NAVAIR

F/A-18 E/F & EA-18G
Integrated Architecture

Active Electronically Scanned Array (AESA)

Advanced Targeting FLIR (ATFLIR)

SHARED Reconnaissance POD(SHARP)

Weapons Integration

ARC210 DCS (VMF)

Joint Helmet Mounted Cueing System (JHMCS)

Advanced Crew Station (ACS)

Multi-Functional Information Distribution System (MIDS)

Advanced Mission Computer & Displays(AMCD)

Solid State Video Recorder (SSVR)

Fiber Channel Architecture

8x10 Display

SSR (Frame Grab)

Frame-Grab In and out

Fiber Channel Network Switch #2 (16x16)

ITB   ITB

AESA | AMC1 | 8x10 Display | AMC2 | EAU | RFCM | JTRS | Wpns Comp | DMD | DMM | ATFLIR | SHARP | TAMMAC DVMC

Secondary Backplane

Fiber Channel Network Switch #1 (16x16)

High Speed Data Network
Digital Video Network
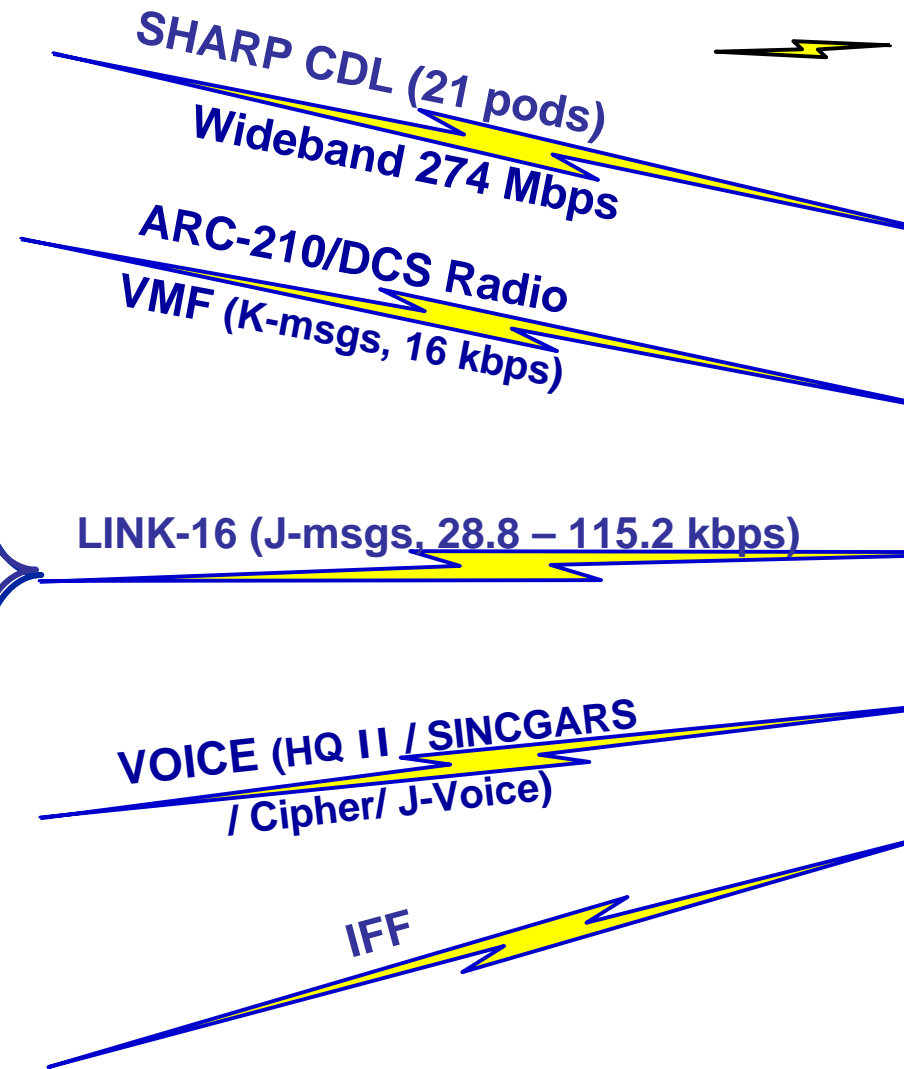Image Transfer BUS (ITB)
AMC-to-AMC(2nd Backplane)

> **Scalable, Portable, Flexible and Open Architecture**
> **Modular HOL(C++) Software Organization SEI CMM Level 5**

Today's F/A-18 Interoperability Capabilities

Current F/A-18 INTEROPERABILITY = LINK-16 + VMF + CDL

Samples:

CVN

TIS

E-3

E-8

E-2

F-15

GROUND FORCES

DCGS

TLDHS

TACP

Tactical Data / Voice Exchange [VHF & UHF]

SHARP CDL (21 pods)
Wideband 274 Mbps

ARC-210/DCS Radio
VMF (K-msgs, 16 kbps)

LINK-16 (J-msgs, 28.8 – 115.2 kbps)

VOICE (HQ II / SINCGARS / Cipher/ J-Voice)

IFF
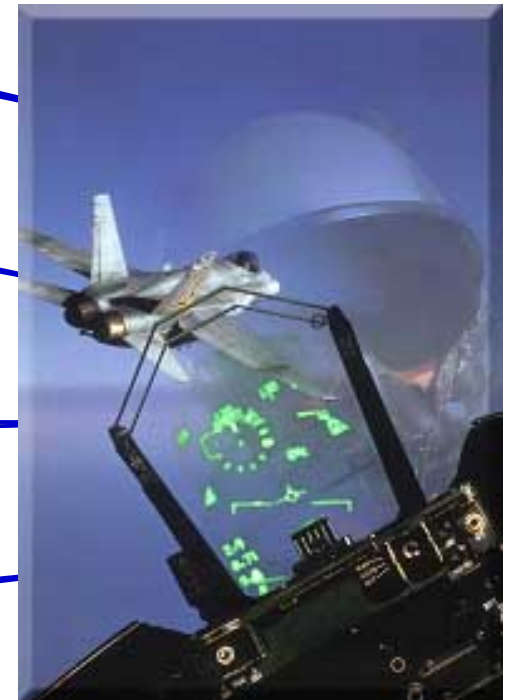
LINK	Mil-Std
CDL	Mil-Std-7681990
L16	Mil-Std-6016
VMF	Mil-Std-188-220

Link 16 in OIF
MIDS Transfer/Designate
(Fielded capability)

FAC(A)

Striker

Benefits

- Machine-to-Machine
- No Voice required
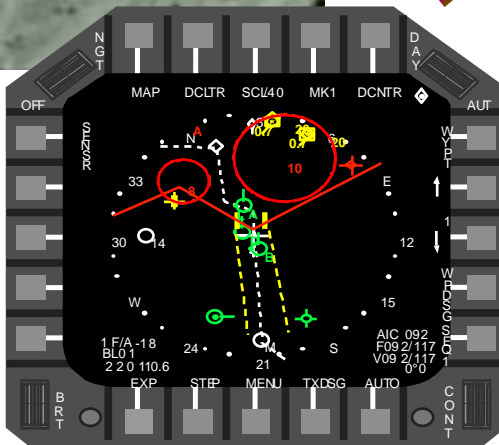- Decreased time in target area
- Shortened Kill Chain

JHMCS

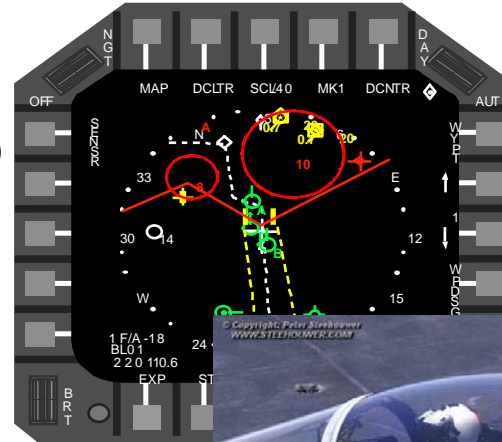F/A-18F FAC(A) acquires/designates target via sensors (JHMCS/ATFLIR)

ATFLIR

FAC(A) sends target designation to CAS striker(s) via L16

Target Designation received by CAS Strike aircraft via L16

MIDS

FAC(A) controls CAS strikers sensors (JHMCS/ATFLIR) on ingress

Early target acquisition/First pass weapon delivery/no loitering

NAV AIR

F/A-18E/F and F/A-18C/D Configured with Link 16 and DCS Radio

Operational View (OV1) M2M Digital Time Sensitive Targeting (TST)

Airborne C2 / DASC

Link-16 and VMF Improvements Oct 05– Apr 08

TARGET COORDINATION –
- **INFLIGHT RE-TARGETING**

FAC(A)/SCAR/Striker

TARGET ENGAGEMENT – L16/VMF
- **INCREASED ACCURACY – HAE**
- **MULTIPLE DMPIs**
- **OFF-BOARD IMAGE MENSURATION**

Command and Control

TARGET COORDINATION
- **IMPROVED JCAS CAPABILITY**

Striker

FAC

- Receive Transfer of target imagery
- Increased Location Precision (J3.5)
- Full Digital JCAS
- Control of aircraft via digital JCAS – L16/VMF
- Multiple Targets
  - Multiple DMPIs (Desired Mean Point of Impact)
  - Multiple CAS Targets
- Off-board Image Mensuration
- Copy/Paste functionality/annotation of imagery

Link 16 and VMF Imagery with Digital CAS Demonstrated 4 Sept, 2003 at St. Louis

Fleet Introduction in October 05

MIDS (Link 16)
Based Upon DoD Approved
J16.0 Imagery Message

DCS (VMF)
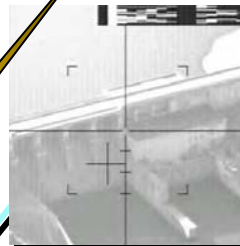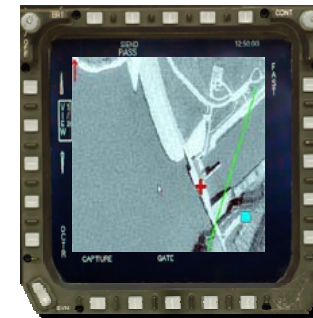Used Prototype VMF 'K'
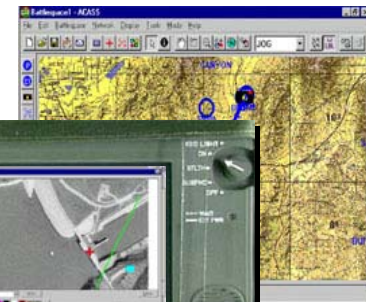Message for Imagery

Imagery

Annotations

Digital 9-Line

F/A-18F1

BDA

Funneling situational awareness

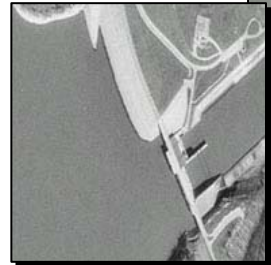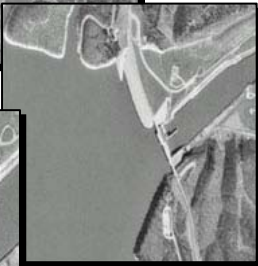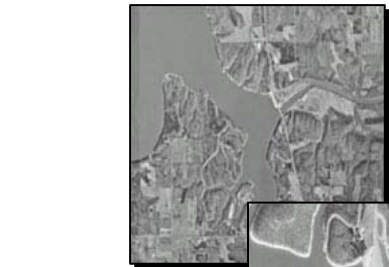| Link 16	14-51 sec
VMF	13-55 sec

FAC(G) with ACASS

Command and control (simulated in lab)

Operationally Useful Transmission Times

- Time Varies Due to Network, Compression & Image Size
- Network Loading Included Over Simulated 50 Tracks

NAV AIR

BHA Image Sequence Captured and Stored by Solid State Recorder (SSR)
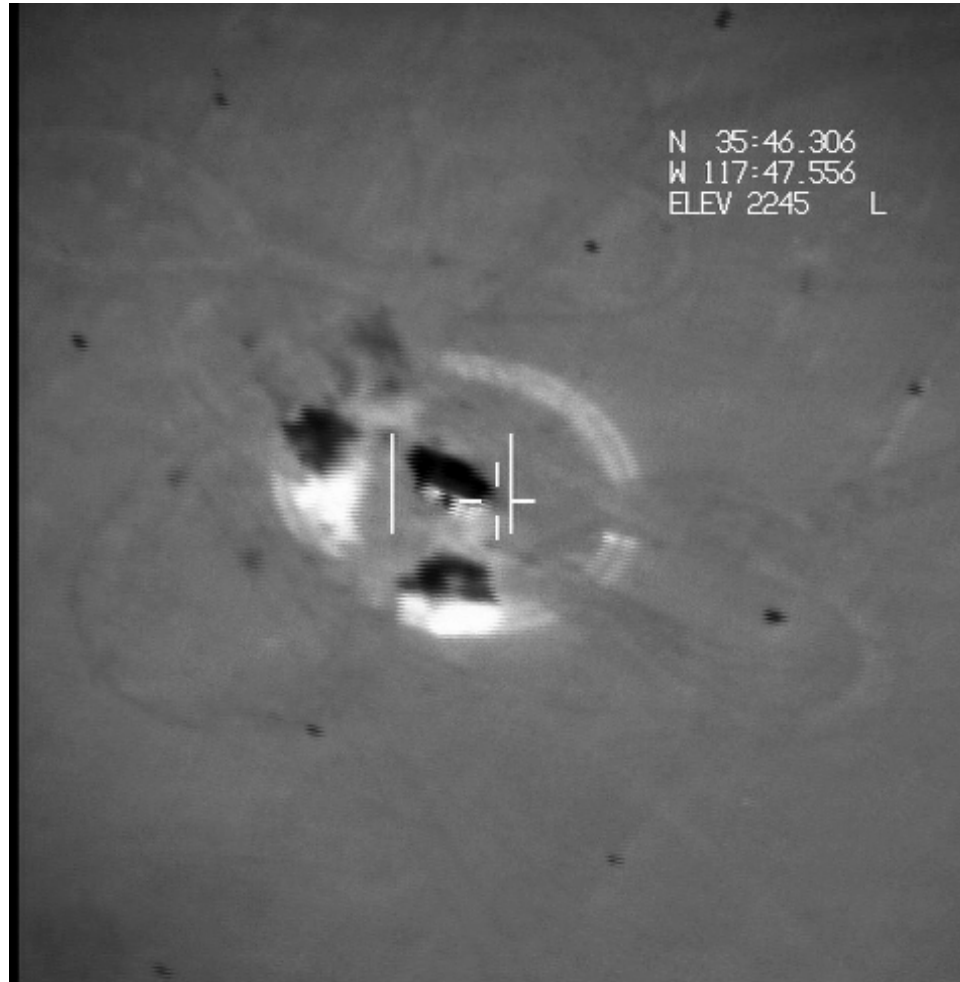
F/A-18 F-1 JDAM MTE Demo Concept and Implementation
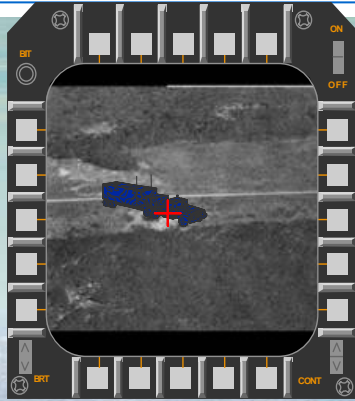
ATFLIR single Moving Target Track (MTT)

Hornet tracks moving target with ATFLIR and transmits In-Flight Target Updates (IFTUs) to JDAM via DCS VMF K02.57 modified msg

F/A-18 F-1 ATFLIR and ARC-210

JDAM steers out updated target coordinates (Relative Targeting Mode)

JDAM UHF Network Link

UHF IFTUs

Weapon transmits back IFTU message acknowledge
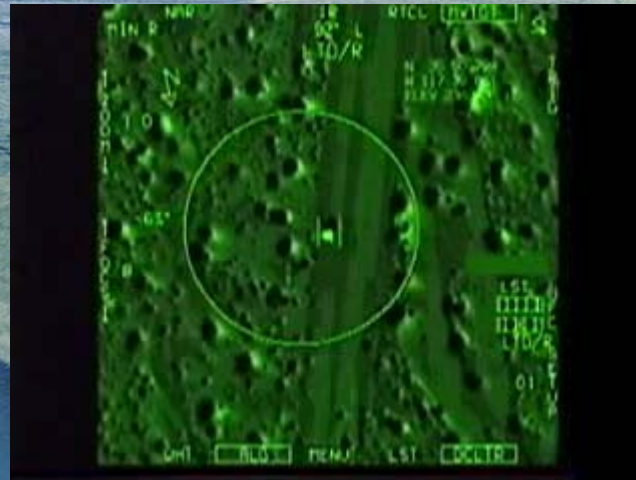
• **Constant speed and heading target**

F/A-18 & EA-18G
- The Next Spiral -

- The platform must seamlessly move its sensor and weapon information on/off the aircraft, then into and across a joint, networked Battle Space

- Information Superiority achieved in a machine-to-machine environment ensures distributed sensors on the tactical edge of Battle Space deliver combat power from the right platform, at the right time with the right weapon

- Information Elements
- Std & Arch Implementation
- Network Spec
- ICDs
- COI's and Training
- CONOPS
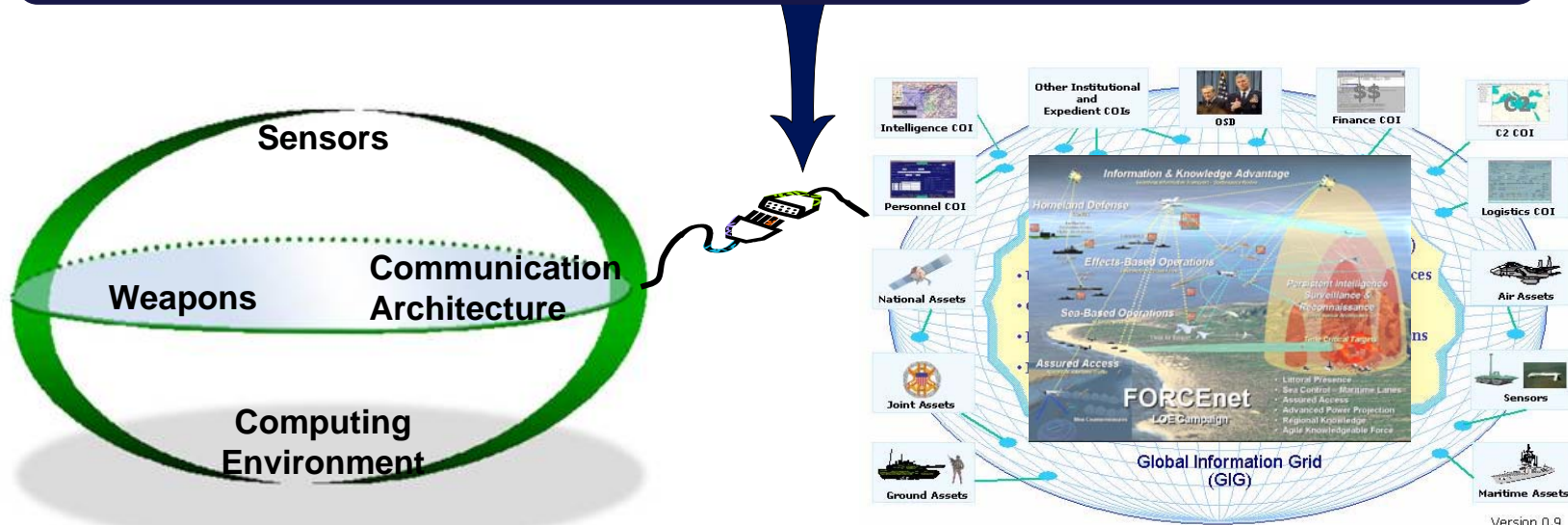
Information Superiority= Increased Speed with Increased Precision

BSN Operational View & F/A-18 & EA-18G Architecture

Legacy (e.g., C/D)

Legacy

EA-18G

E-2

BSN IP Backbone

IP BSN

BSN Tactical Edge

F/A-18 E/F

TACP / SOF
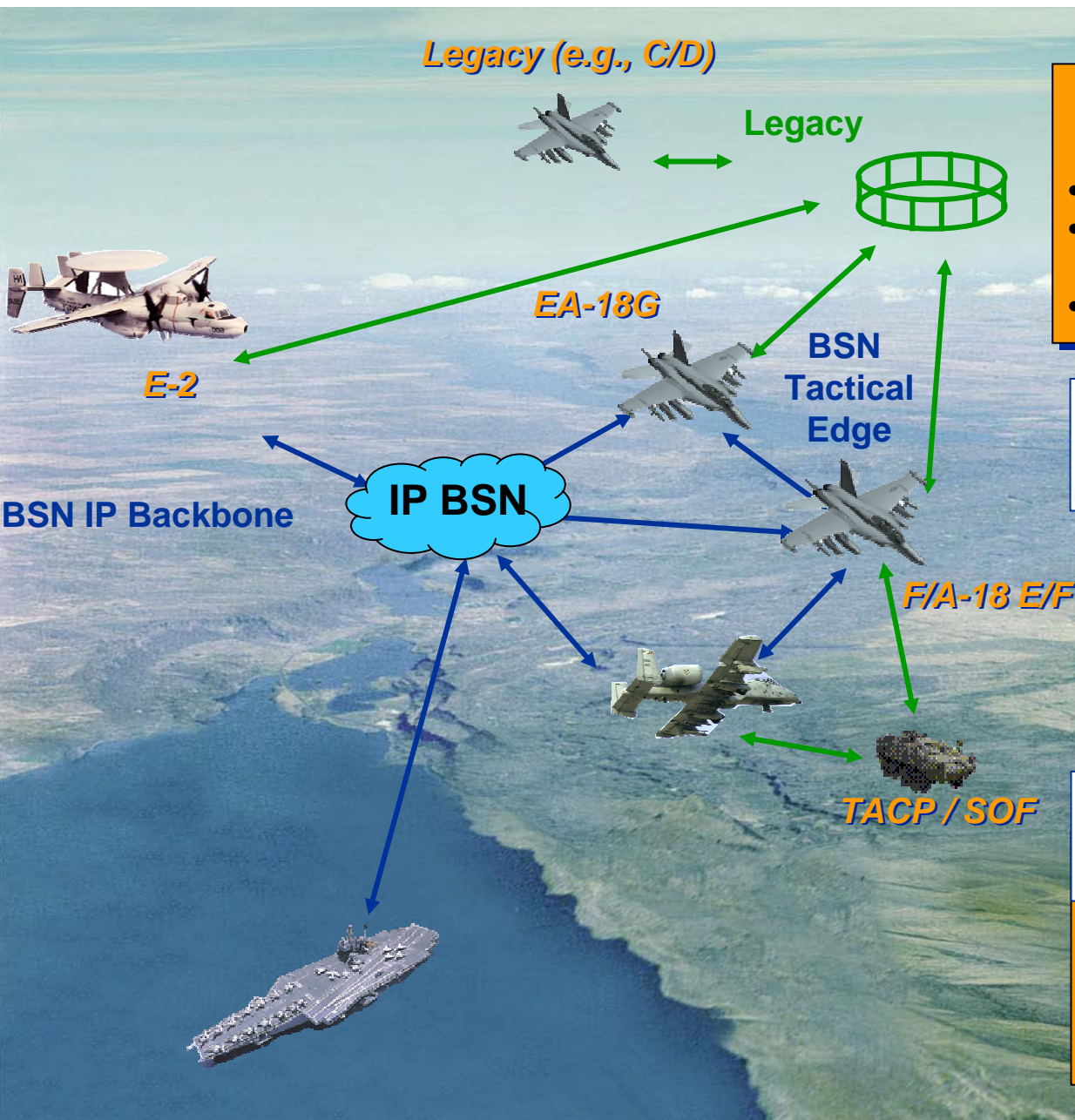
Platform Applications

- Mission Processing (e.g., AMC, IMEX)
- Platform Specific Applications (e.g., HMI, Targeting)
- Mission Applications (e.g., Distributed Fusion)
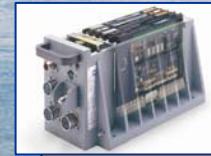
Network Interface

- Network Processor
- Mission Applications (e.g., BFT, Imagery)
- Network Services (i.e., Middleware)

Communications Infrastructure

- MIDS-JTRS
- RF (e.g., Antennas, Power Amps, etc.)
- Waveforms

JEFX06 Architecture
(April 2006)

Link 16

TTNT

AWACS

Increment 1 (H2E+)

Suite 5

BACN

E-2 xHawk

Targets as J-msg

F/A-18F1

F-15E1

B-52

B-1

SOF

Targets in XML
Video
VoIP

IP-based Network Connectivity

Link 16

TBONE WEEMC

Web Services

TBONE WEEMC

JFACC
(Nellis CAOC-N)

JFMCC
China Lake IBAR

Applications

- Mission Assignment
- Target Data Package
- Own-ship Heartbeat / Status Message
- Imagery with Annotations
- Blue Force Situational Awareness
- Streaming Video
- Sensor Point of Interest
- Voice over IP
- Common Grid Reference System

• Lab Interoperability Testing	**Aug 2005**
• Local STL flights	**Aug 2005**
• DARPA Phase III flights	**Sept 2005**
• Lab Integration Testing	**Jan 2006**
• JEFX 06 Spiral 3 Live Fly	**Mar 2006**
• JEFX 06 Main Ex Live Fly	**May 2006**

JEFX-06
NTISR and TST Mission Threads (Notional)

3 ABC2 digitally tasks F/A-18/F15 To investigate target and provide imagery

6 ABC2 digitally tasks F/A-18/F15 To destroy target and provide BHA

ABC2

2 CAOC digitally requests Airborne assets investigate And provide ISR

4 F/A-18 images target thru the Weather via AESA, produces Mensurated coordinates using Geo-reg/ICT, and digitally sends Both back to CAOC via ABC2/E2C

Command and Control

5 CAOC assigns targets as Actionable and digitally tasks Airborne assets

Obscured Target Area (Smoke or Overcast)

7 F/A-18/F15 Attacks target Thru weather using Geo-reg/ICT generated Coordinates and Provide BHA Imagery to CAOC Via ABC2

SOF

1 SOF locates possible Target and relays info Back to CAOC

24

Full Network Centric Operations and Warfare

Shared Data

BFSA Database

Image Database

Threat Database

Maintenance Systems

NCOW CONOPS
- Develop
- Implement
- Experimentation

IP Network

IP Network

Shared Services

Command & Control

Target Package Generator

Weather

Mission Planning

COP

IP BSN

Connected via combination of
MANET and legacy TADILs

IP-Based Waveform TTNT

MIDS-JTRS/SATCOM/IBS

F/A-18 & EA-18G

Mission	**Cockpit Tasking**	**Publish and Subscribe**
Strike, FAC(A), CAS OCA/DCA, RECCE, Tanking, Time Sensitive Strike, SEAD, Strike Escort, EW-CAS, Strike Coordination Recce (SCAR), CSAR	Detect/ID, Target Coordination Comms: Link 16, DCS, Voice Sensors: SAR Maps, EO/IR, HARM/EW, Login, Develop Information Elements for publish and subscribe	Imagery/ISR, Sat Imagery, Intel & Weather Text Messages Sat Data, Inflight Retargeting EW Parametrics Location Blue/Red Force Location

Questions?

NAVAIR